INDOOR AIR QUALITY ASSESSMENT

Bridgewater Elementary School
500 South Street
Bridgewater, Massachusetts

Prepared by:
Massachusetts Department of Public Health
Center for Environmental Health
Bureau of Environmental Health Assessment
Emergency Response/Indoor Air Quality Program
April 2004

Background/Introduction

In the Fall of 2001, the Massachusetts Department of Public Health (MDPH) submitted a proposal to the US Centers for Disease Control (CDC) to establish an environmental health tracking program in Massachusetts. CDC funded the Commonwealth of Massachusetts to develop the capacity for collecting a variety of health and environmental data, among which was a proposal to track indoor air quality in public schools. Over the course of this three year project, the MDPH proposes to evaluate indoor air quality in more than 100 schools. In addition, four communities who requested state assistance in evaluating indoor air quality were asked to participate in a focused effort involving more frequent evaluations of indoor air quality.

In response to concerns from parents and staff at the Bridgewater Elementary School (BES), Stanley Kravitz, Health Agent, Bridgewater Board of Health (BOH), requested assistance in evaluating indoor air quality at the BES in August 2003. The Bridgewater Elementary School (BES) is located at 500 South Street, Bridgewater, Massachusetts. At the time of the request, the primary concern was mold growth. MDPH agreed to conduct a mold evaluation and asked Mr. Kravitz to collaborate with the Department by participating in the environmental tracking project. Mr. Kravitz agreed to have Bridgewater be included as one of the communities with a school scheduled more frequent sampling is planned.

This BES assessment consists of two separate activities. On August 20 and 21, 2003, a visit was made by Michael Feeney, Director of Emergency Response/Indoor Air Quality (ER/IAQ), Bureau of Environmental Health (BEHA). The assessment was conducted prior to school opening for the 2003-2004 school year. Mr. Feeney was

accompanied by Doug Sime, Assistant Health Agent, BOH and James Perry, Clerk, BOH. As mentioned, the purpose of the August visit was to address on-going concerns of mold and to assess remedial efforts taken at the BES. The assessment also sought to determine whether the excessively hot, humid weather in August 2003 had created conditions that could have led to new mold colonization of building components. An evaluation of remedial measures in response to the BEHA November 1999 assessment are included as Appendix A of this report.

After renovations were completed, Cory Holmes and Sharon Lee, Environmental Analysts for BEHA's ER/IAQ program, returned to the building on November 24, 2003 to conduct a general IAQ assessment as part of the Department's environmental public health tracking effort. As discussed, BEHA plans to conduct further air sampling at the BES over the course of this current school year. Results from the air sampling conducted subsequent to the November 2003 visit will be the subject to a separate report.

The school is a two-story, E-shaped brick building constructed in the mid-late 1990s and first occupied in 1997. The second floor includes general classrooms and administrative offices. The first floor also consists of general classrooms, as well as the library, cafeteria, computer lab, and the gymnasium.

Methods

BEHA staff conducted air tests for carbon dioxide, carbon monoxide, temperature and relative humidity with the TSI, Q-TRAK™ IAQ Monitor, Model 8551. Air tests for airborne particle matter with a diameter less than 2.5 micrometers were taken with the TSI, DUSTTRAK™ Aerosol Monitor Model 8520. Screening for total volatile organic

compounds (TVOCs) was conducted using a Thermo Environmental Instruments Inc., Model 580 Series Photo Ionization Detector (PID).

Results

This school has a student population of 1,435 and a staff of approximately 147 (122 full-time and 25 part-time). The tests were taken during normal operations at the school. Test results appear in Table 1.

Discussion

Ventilation

It can be seen from Table 1 that carbon dioxide levels were elevated above 800 ppm in forty-eight of seventy-five areas surveyed, indicating inadequate ventilation in a number of areas. Some classrooms had open windows or were sparsely populated during the assessment, which can greatly contribute to reduced carbon dioxide levels.

Fresh air in classrooms is supplied by a unit ventilator (univent) system. Univents draw air from outdoors through a fresh air intake located on the exterior walls of the building and return air through an air intake located at the base of each unit (Figure 1). Univents in the first (ground) floor are ceiling mounted in most areas, with fresh air intakes located above windows on the exterior walls. Several areas, including the library and computer room, draw fresh air from vents located in the roof. Fresh and return air are mixed, filtered, heated and provided to classrooms through an air diffuser located in the top of the unit. Obstructions to airflow, such as papers and books stored on top of univents and bookcases and carts and desks placed in front of univent returns, were seen

in a number of classrooms (Picture 1). In order for univents to provide fresh air as designed, intakes must remain free of obstructions. The univent in room 117 was not operating during the assessment and was on order to be repaired.

The mechanical exhaust ventilation system in each classroom consists of ducted, grated wall vents. Exhaust vents were found obstructed by cabinets, desks, or other items (Picture 2). As with the univents, exhaust vents must also remain free of obstructions in order to function as designed.

To maximize air exchange, the BEHA recommends that both supply and exhaust ventilation operate continuously during periods of school occupancy. In order to have proper ventilation with a univent and exhaust system, the systems must be balanced to provide an adequate amount of fresh air to the interior of a room while removing stale air from the room. It is recommended that HVAC systems be re-balanced every five years (SMACNA, 1994).

The Massachusetts Building Code requires a minimum ventilation rate of 15 cubic feet per minute (cfm) per occupant of fresh outside air or have openable windows in each room. The ventilation must be on at all times that the room is occupied. Providing adequate fresh air ventilation with open windows and maintaining the temperature in the comfort range during the cold weather season is impractical. Mechanical ventilation is usually required to provide adequate fresh air ventilation.

The Massachusetts Building Code requires that each room have a minimum ventilation rate of 15 cubic feet per minute (cfm) per occupant of fresh outside air or have openable windows (SBBRS, 1997; BOCA, 1993). The ventilation must be on at all times that the room is occupied. Providing adequate fresh air ventilation with open windows

and maintaining the temperature in the comfort range during the cold weather season is impractical. Mechanical ventilation is usually required to provide adequate fresh air ventilation.

Carbon dioxide is not a problem in and of itself. It is used as an indicator of the adequacy of the fresh air ventilation. As carbon dioxide levels rise, it indicates that the ventilating system is malfunctioning or the design occupancy of the room is being exceeded. When this happens a buildup of common indoor air pollutants can occur, leading to discomfort or health complaints. The Occupational Safety and Health Administration (OSHA) standard for carbon dioxide is 5,000 ppm. Workers may be exposed to this level for 40 hours/week based on a time-weighted average (OSHA, 1997).

The MDPH uses a guideline of 800 ppm for publicly occupied buildings. A guideline of 600 ppm or less is preferred in schools due to the fact that the majority of occupants are young and considered to be a more sensitive population in the evaluation of environmental health status. Inadequate ventilation and/or elevated temperatures are major causes of complaints such as respiratory, eye, nose and throat irritation, lethargy and headaches. For more information concerning carbon dioxide, please see Appendix A.

Temperature measurements ranged from 63^{o} F to 76^{o} F, which were below the BEHA comfort guidelines in some areas. The BEHA recommends that indoor air temperatures be maintained in a range of 70^{o} F to 78^{o} F in order to provide for the comfort of building occupants. In many cases concerning indoor air quality, fluctuations of temperature in occupied spaces are typically experienced, even in a building with an adequate fresh air supply.

Relative humidity readings taken during the assessment were in a range between 32 to 53 percent, which were below the BEHA recommended range in some areas. The BEHA recommends a comfort range of 40 to 60 percent for indoor air relative humidity. Relative humidity levels in the building would be expected to drop during the winter months due to heating. The sensation of dryness and irritation is common in a low relative humidity environment. Low relative humidity is a very common problem during the heating season in the northeast part of the United States.

Moisture/Microbial Concerns

During the assessment, BEHA staff found an insulation sheet in a storage closet that appeared to be colonized with mold (Picture 3). The storage closet also had a noticeable musty odor. BEHA staff recommended that this sheet be removed from the BES. In a subsequent conversation, BES staff reported that the item removed from the school.

Open seams between the sink countertop and wall were observed in several rooms (Picture 4). If not watertight, water can penetrate through the seam, causing water damage. Water penetration and chronic exposure of porous and wood-based materials can cause these materials to swell and show signs of water damage. Moistened materials that are not dried within 24 to 48 hours can become potential sources for mold growth.

Other sources for water damage were also observed. Caulking around windows was missing/damaged in many areas (Picture 5). Missing caulking can make temperature control difficult. It can also allow water to penetrate the building. Replacement of

caulking and repairs of window leaks are necessary to prevent water penetration and subsequent damage to building materials, which can lead to mold growth.

Other Concerns

Indoor air quality can be adversely impacted by the presence of respiratory irritants, such as products of combustion. The process of combustion produces a number of pollutants; however, the pollutant produced is dependent on the material combusted. Common combustion products include carbon monoxide, carbon dioxide, water vapor and smoke (fine airborne particle material). Of these materials, exposure to carbon monoxide and particulate matter with a diameter of 2.5 micrometers (μm) or less (PM2.5) can produce immediate, acute health effects upon exposure. To determine whether combustion products were present in the school environment, BEHA staff obtained measurements for carbon monoxide and PM2.5 on November 24, 2003. Outdoor carbon monoxide concentrations were measured at 0 to 1 ppm (Table 1). Carbon monoxide levels measured in the school reflect levels measured outdoors.

Several air quality standards have been established to address carbon monoxide pollution and prevent symptoms from exposure to these substances. The MDPH established a corrective action level concerning carbon monoxide in ice skating rinks that use fossil-fueled ice resurfacing equipment. If an operator of an indoor ice rink measures a carbon monoxide level over 30 ppm, taken 20 minutes after resurfacing within a rink, that operator must take actions of reduce carbon monoxide levels (MDPH, 1997).

ASHRAE has adopted the National Ambient-Air Quality Standards (NAAQS) as one set of criteria for assessing indoor air quality and monitoring of fresh air introduced

by HVAC systems (ASHRAE, 1989). The NAAQS are standards established by the US EPA to protect the public health from 6 criteria pollutants, including carbon monoxide and particulate matter (US EPA, 2000). As recommended by ASHRAE, pollutant levels of fresh air introduced to a building should not exceed the NAAQS (ASHRAE, 1989). The NAAQS were adopted by reference in the Building Officials & Code Administrators (BOCA) National Mechanical Code of 1993 (BOCA, 1993), which is now an HVAC standard included in the Massachusetts State Building Code (SBBRS, 1997). According to the NAAQS established by the US EPA, carbon monoxide levels in outdoor air should not exceed 9 ppm in an eight-hour average (US EPA, 2000).

Carbon monoxide is a by-product of incomplete combustion of organic matter (e.g., gasoline, wood and tobacco). Exposure to carbon monoxide can produce immediate and acute health affects. *Carbon monoxide should not be present in a typical, indoor environment.* If it *is* present, indoor carbon monoxide levels should be less than or equal to outdoor levels.

The NAAQS originally established exposure limits for particulate matter with a diameter of 10 μm or less (PM10). According to the NAAQS, PM10 levels should not exceed 150 micrograms per cubic meter ($\mu g/m^3$) in a 24-hour average. This standard was adopted by both ASHRAE and BOCA. Since the issuance of the ASHRAE standard and BOCA Code, US EPA proposed a more protective standard for fine airborne particles. This more stringent, PM2.5 standard requires outdoor air particulate levels be maintained below 65 $\mu g/m^3$ over a 24-hour average. Although both the ASHRAE standard and BOCA Code adopted the PM10 standard for evaluating air quality, BEHA uses the more protective proposed PM2.5 standard for evaluating airborne particulate matter

concentrations in the indoor environment. Outdoor PM2.5 concentrations were measured at 5 $\mu g/m^3$ (Table 1). PM2.5 levels measured in the school reflect levels measured outdoors.

Indoor air quality can also be impacted by the presence of materials containing volatile organic compounds (VOCs). VOCs are substances that have the ability to evaporate at room temperature. Frequently, exposure to low levels of total VOCs (TVOCs) may produce eye, nose, throat and/or respiratory irritation in some sensitive individuals. For example, chemicals evaporating from a paint can stored at room temperature would most likely contain VOCs. In an effort to determine whether VOCs were present in the building, air monitoring for TVOCs was conducted. Outdoor air samples were taken for comparison. Outdoor TVOC concentrations were non-detect (ND) (Table 1). Indoor TVOC measurements throughout the building were also ND. Please note, that the TVOC air measurements are only reflective of the indoor air concentrations present at the time of sampling. Indoor air concentrations can be greatly impacted by the use TVOC containing products (e.g., use of product increases the concentration of TVOC within a classroom).

In an effort to identify materials that can potentially increase indoor TVOC concentrations, BEHA staff examined classrooms for products containing these respiratory irritants. Several classrooms contained dry erase boards and dry erase markers. Many of the dry erase marker trays had accumulated dry erase materials (Picture 6). Materials such as dry erase markers and dry erase board cleaners may contain volatile organic compounds (VOCs), (e.g., methyl isobutyl ketone, n-butyl

acetate and butyl-cellusolve) (Sanford, 1999), which can be irritating to the eyes, nose and throat.

Strong odors were detected in classrooms 225 and 229. The source of these odors appeared to be plug-in type air fresheners. Air fresheners contain chemicals that can be irritating to the eyes, nose and throat of sensitive individuals. Furthermore, air fresheners do not remove materials causing odors, but rather mask odors that may be present in the area.

Cleaning products were also found under sinks and on countertops in a number of classrooms (Picture 7). Cleaning products contain chemicals, which can be irritating to the eyes, nose and throat, and should be stored properly and out of the reach of students.

Also of note was the amount of materials stored inside classrooms. In classrooms throughout the school, items were observed on windowsills, tabletops, counters, bookcases and desks. The large number of items stored in classrooms provides a source for dusts to accumulate and make it difficult for custodial staff to clean. Dust can be irritating to eyes, nose and respiratory tract. Items should be relocated and/or be cleaned periodically to avoid excessive dust build up.

Accumulated chalk dust was noted in some classrooms. Chalk dust is a fine particulate that can easily become aerosolized, irritating eyes and the respiratory system. Similarly, pencil shavings were observed to be accumulating at the base of pencil sharpeners (Picture 8). In many classrooms, pencil sharpeners are stationed on bookcases located in front of windows or near univents. Clay art projects were also placed near windows and on top of univents. Dry clay materials produce dust (Picture 9). Open

windows and operating univents can aerosolize pencil shavings and clay dust, which are sources for eye and respiratory irritation.

Inactive bird's nests and bird feathers were noted in classrooms and reportedly serve as learning tools (Picture 10). Bird's nests can contain bacteria and may also be a source of allergenic material as can feathers. Feathers and nests should be placed in re-sealable bags to prevent aerosolization of allergenic material. These items should also be located away from univents fresh air diffusers.

Lastly, several rooms had missing and/or dislodged ceiling tiles (Picture 11). Missing/dislodged ceiling tiles can provide a pathway for the movement of drafts, dusts and particulate matter between rooms and floors. Items were also observed hanging from ceiling tiles. The movement or damage to ceiling tiles can release accumulated dirt, dust and particulates that accumulate in the ceiling plenum into occupied areas. As previously discussed, dust can be irritating to the eyes, nose and respiratory tract. Building occupants should refrain from hanging objects from ceiling tile systems.

Conclusions/Recommendations

Based on findings at the time of the assessment, the following recommendations were made:

1. Consider developing a written notification system for building occupants to report indoor air quality issues/problems, if one is not already in place. Have these concerns relayed to the maintenance department/ building management in a manner to allow for a timely remediation of the problem.

2. Examine each univent for function. Survey classrooms for univent function to ascertain if an adequate air supply exists for each room. Operate univents while classrooms are occupied. Check fresh air intakes for repair and increase the percentage of fresh air intake if necessary.
3. Remove all blockages from univents and exhaust vents to ensure adequate airflow.
4. Maximize air exchange. The BEHA recommends that all ventilation systems that are operable throughout the building (e.g., gym, auditorium, classrooms) operate continuously during periods of school occupancy independent of thermostat control.
5. Consult a ventilation engineer concerning balancing of the ventilation systems. Ventilation industrial standards recommend that mechanical ventilation systems be balanced every five years (SMACNA, 1994).
6. Adopt scrupulous cleaning practices. For buildings in New England, periods of low relative humidity during the winter are often unavoidable. Therefore, scrupulous cleaning practices should be adopted to minimize common indoor air contaminants whose irritant effects can be enhanced when the relative humidity is low. To control for dusts, a HEPA filter equipped vacuum cleaner in conjunction with wet wiping of all surfaces is recommended. Drinking water during the day can help ease some symptoms associated with a dry environment (throat and sinus irritations).
7. Replace missing ceiling tiles to prevent the egress of dirt, dust and particulate matter into classrooms. Refrain from hanging objects from ceiling tile system.

8. Relocate or consider reducing the amount of materials stored in classrooms to allow for more thorough cleaning. Clean items regularly with a wet cloth or sponge to prevent excessive dust build-up.
9. Remove pencil sharpeners and clay projects from the vicinity of windows and univents.
10. Store cleaning products properly and out of reach of students.
11. Store birds' nests and feathers in resealable bags, away from univents.
12. Refrain from using strongly scented materials (e.g., air fresheners) in classrooms.
13. Consult "Mold Remediation in Schools and Commercial Buildings" published by the US Environmental Protection Agency (US EPA, 2001) if future mold growth should appear. Copies of this document can be downloaded from the US EPA website at: http://www.epa.gov/iaq/molds/mold_remediation.html.
14. Consider adopting the US EPA document, "Tools for Schools", to maintain a good indoor air quality environment on the building. This document can be downloaded from the Internet at: http://www.epa.gov/iaq/schools/index.html.
15. Refer to the resource manual and other related indoor air quality documents for further building-wide evaluations and advice on maintaining public buildings. These materials are located on the MDPH's website at: http://www.state.ma.us/dph/beha/iaq/iaqhome.htm.

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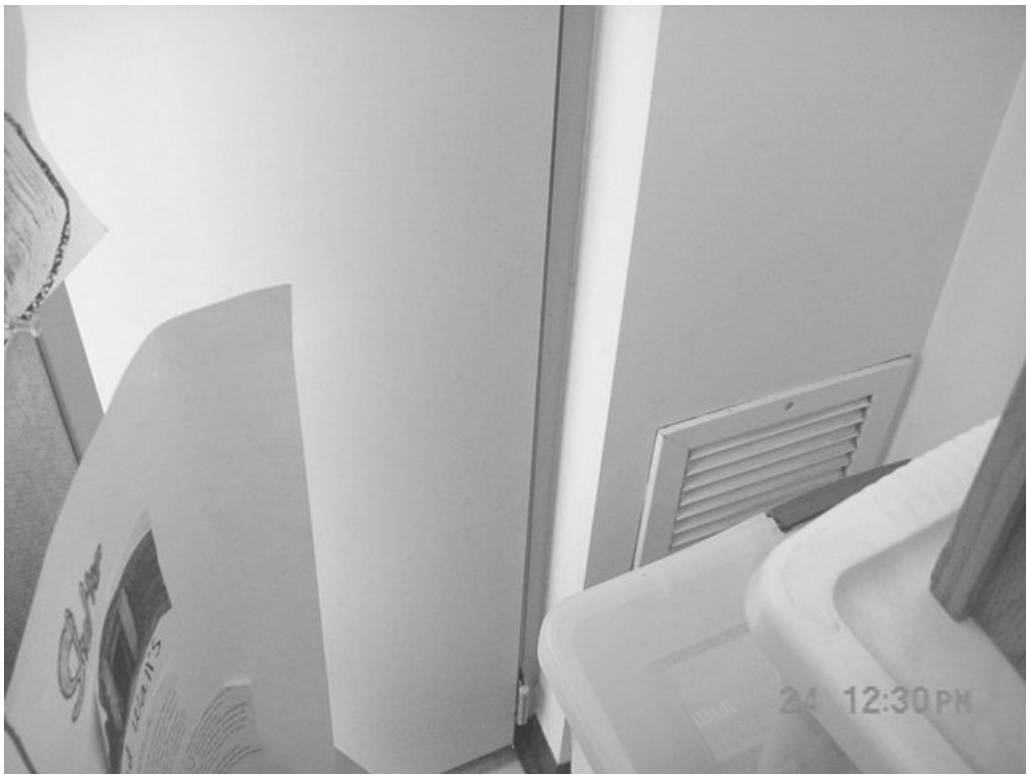
Picture 1

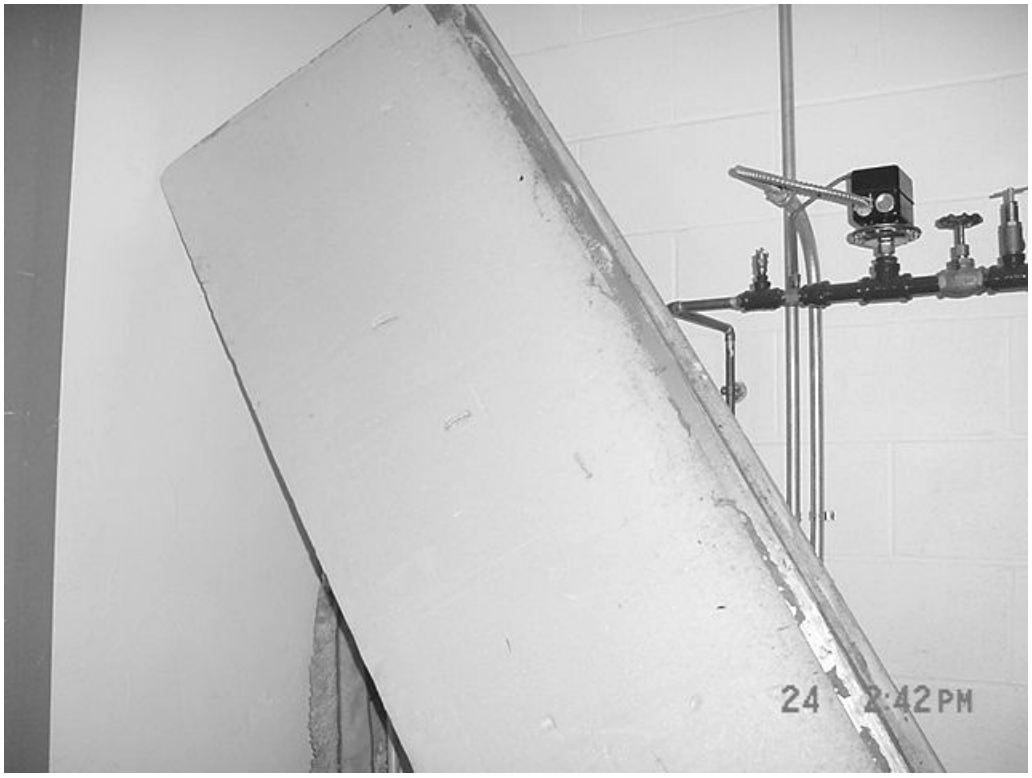
Accumulated Items in Classroom Obstructing Univent

Picture 2



Obstructed Exhaust Vent in Classroom

Picture 3



Water Damaged Fiberboard Insulation

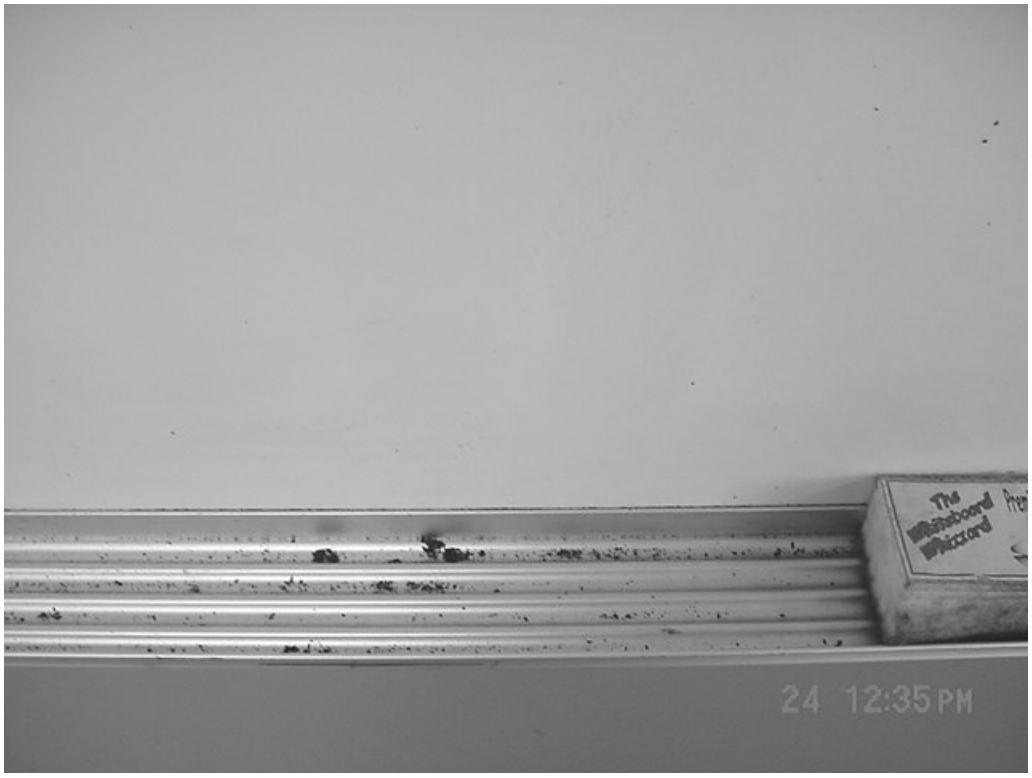
Picture 4

Breach Between In Sink Backsplash

Picture 5

Damaged Window Caulking

Picture 6



Accumulated Dry Erase Marker Debris

Picture 7

Cleaners Found in a Sink Cabinet

Picture 8

Pencil Shavings accumulated at the base of a Pencil Sharpener and Univent

Picture 9

Clay Art projects Drying on Top of Univent

Picture 10

Birds' nests

Picture 11

Building: Bridgewater Elementary School **Indoor Air Test Results**
Address: Bridgewater, MA **Date: November 24, 2004**

TABLE 1

Location/Room	Occupants in Room	Temp (°F)	Relative Humidity (%)	Carbon Dioxide (*ppm)	CO (ppm)	TVOCs (ppm)	PM (µg/m³)	Windows Openable	Ventilation		Remarks
									Supply	Exhaust	
Background		50	53	493	ND	ND	5				
235	25	65	53	964	ND	ND	3	Y	Y	Y	Clutter, Cleaners, Coffee maker, Pencil sharpener, Supply blocked by plants and clutter
233	26	70	42	1235	ND	ND	2	Y	Y	Y	Clutter, Cleaners, Food storage/use, Items hanging from ceiling, Supply blocked by clutter and furniture
234	28	65	44	1338	ND	ND	2	N	Y	Y	Cleaners under sink, Food storage/use, Supply blocked by clutter and boxes
232	28	73	38	1140	ND	ND	3	Y	Y	Y	2 MT/AT, DEM, Plants, Clutter, Cleaners, Supply blocked by clutter, Exhaust blocked by clutter and clothing

ppm = parts per million parts of air

AD = air deodorizer
AHU = air-handling unit
AP = air purifier
AC = air conditioning
CD = chalk dust
CT= ceiling tile
DEM = dry erase marker
DO = door open
MT= missing ceiling tile
PC = photocopier
PF = personal fan
TB = tennis balls
UF = upholstered furniture
WD = water damage
ND = non-detect

Comfort Guidelines

Carbon Dioxide -	< 600 ppm = preferred
	600 - 800 ppm = acceptable
	> 800 ppm = indicative of ventilation problems
Temperature -	70 - 78 °F
Relative Humidity -	40 - 60%

Building: Bridgewater Elementary School
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Indoor Air Test Results
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Location/Room	Occupants in Room	Temp (°F)	Relative Humidity (%)	Carbon Dioxide (*ppm)	CO (ppm)	TVOCs (ppm)	PM (µg/m³)	Windows Openable	Ventilation		Remarks
									Supply	Exhaust	
225	29	69	34	1336	ND	ND	3	Y	Y	Y	CD, DEM, Plug in air freshener, Items hanging from ceiling, Supply blocked by clutter, Exhaust blocked by furniture
231	27	69	35	1160	ND	ND	3	Y	Y	Y	CD, DEM, Cleaners, Supply blocked by clutter
226	29	68	35	1240	ND	ND	3	Y	Y	Y	CD, DEM, Clutter, Items hanging from ceiling, Pencil sharpener by supply
230	24	71	36	835	ND	ND	3	Y	Y	Y	CD, DEM, Hole in wall, Supply blocked by clutter and furniture, Exhaust blocked by furniture
227	21	68	35	1040	ND	ND	3	Y	Y	Y	CD, DEM, Clutter, Cleaners, Supply occluded with dirt/debris, Exhaust blocked by furniture

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229	23	75	37	1086	ND	ND	3	N	Y	Y	CD, Clutter, DEM, Plug in air freshener, Exhaust blocked by furniture, 1 WD-CT
228	29	70	34	1066	ND	ND	3	Y	Y	Y	DEM, Cleaners, Pencil sharpeners, Univent odor, Supply blocked by clutter, Exhaust blocked by furniture
125	33	69	35	776	ND	ND	3	N	Y	Y	CD, DH, DEM, Cleaners
126	4	72	35	686	ND	ND	3	N	Y	Y	DH, PF, Cleaners, Photocopier, Wall mounted A/C, Perfume, Exhaust blocked by clutter and furniture
127	29	73	35	906	ND	ND	3	Y	Y	N	CD, DH, DEM, Cleaners, Exhaust blocked by furniture

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124	18	69	34	793	ND	ND	3	N	Y	Y	1 MT/AT, CD, DEM, Cleaners, Exhaust blocked by clutter and furniture
123	26	6	35	889	ND	ND	3	Y	Y	Y	CD, DH, DEM, Cleaners, Exhaust blocked by clutter and furniture
128	26	76	37	1021	ND	ND	3	Y	Y	Y	CD, DH, DEM, Plants, Cleaners, Exhaust blocked by clutter and furniture
122	27	69	36	1040	ND	ND	3	Y	Y	Y	Breach at sink/counter, CD, DEM, Cleaners, Aquarium, Terrarium
129	7	70	35	871	ND	ND	3	Y	Y	Y	DEM, Cleaners, Exhaust blocked by furniture
121	30	72	36	860	ND	ND	3	Y	Y	Y	DH, DEM, Cleaners, Aquarium, Exhaust blocked by furniture
Faculty	21	71	37	1254	ND	ND	3	N	Y	Y	CD, PF

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Cafeteria 3	11	68	33	720	ND	ND	3	N	Y	Y	Hole in wall
Cafeteria 2	60	67	34	742	ND	ND	3	N	Y	Y	PF, Hole in wall
Cafeteria 1	504	63	34	683	ND	ND	3	Y	Y	Y	
117	30	68	43	1710	ND	ND	6	Y	N	Y	CD, DEM, Cleaners, 1 MT/AT, Breach sink/counter, Exhaust blocked by clutter
116	2	72	34	568	ND	ND	3	Y	Y	Y	CD, DH, DEM, Cleaners, Exhaust blocked by clutter and furniture
115	29	76	38	1209	ND	ND	3	N	Y	Y	CD, DH, DEM, Plants, Cleaners, birds nests, Rattling noise in supply, Exhaust blocked by clutter, Breach sink/counter
118	28	72	35	1278	ND	ND	3	Y	Y	Y	CD, DH, DEM, Cleaners, Exhaust blocked by clutter

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Address: Bridgewater, MA

Indoor Air Test Results
Date: November 24, 2004

TABLE 1

Location/Room	Occupants in Room	Temp (°F)	Relative Humidity (%)	Carbon Dioxide (*ppm)	CO (ppm)	TVOCs (ppm)	PM (µg/m³)	Windows Openable	Ventilation		Remarks
									Supply	Exhaust	
114	1	69	32	650	ND	ND	3	Y	Y	Y	CD, DH, PF, DEM, Cleaners, Dry sink, breach sink/counter
119	0	69	36	1326	ND	ND	3	Y	Y	Y	CD, DEM, ~60 occupants left 10 minutes, 1 MT/AT
113	25	70	36	1015	ND	ND	3	Y	Y	Y	Dust, Clutter, DH, Cleaners, DEM, Terrarium, Exhaust occluded with dirt/debris
Copy Center	1	69	35	762	ND	ND	4	Y	Y	Y	4 Copiers, 3 Riso, 3 Laminators, Exhaust blocked by furniture
112	2	69	36	912	ND	ND	3	Y	Y	Y	CD, DH, DEM, Dehumidifier not draining to sink, Exhaust blocked by clutter and furniture, 1 MT/AT
Computer Lab	7	65	36	581	ND	ND	3	N	N	N	DH (2), 29 Computers, 1 MT/AT
Gym 3/Gym 2	42	69	39	884	ND	ND	4	N	Y	Y	Exhaust on in Gym 3, off in Gym 2

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									Supply	Exhaust	
Gym 1	0	67	44	1835	ND	ND	6	Y	Y	Y	3 MT/AT, 2 Ceiling fans
105	29	73	45	1268	ND	ND	2	Y	Y	Y	1 MT/AT, CD, DEM, Cleaners, Exhaust occluded by dirt/debris
106	26	75	44	1542	ND	ND	3	N	Y	Y	1 MT/AT, DEM, Cleaners, Exhaust blocked by furniture
107	22	74	39	1121	ND	ND	3	Y	Y	Y	DH, DEM, Cleaners, Clutter, Exhaust blocked by clutter and furniture
104	26	76	37	1155	ND	ND	2	N	Y	Y	DH, DEM, Cleaners, Sensor equipment on table, 1 MT/AT
108	24	75	35	1080	ND	ND	3	N	Y	Y	DH, DEM, Food storage/use, Cleaners, Exhaust blocked by clutter
103	3	71	33	582	ND	ND	2	Y	Y	Y	DH, DEM

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									Supply	Exhaust	
109	34	69	35	837	ND	ND	2	N	Y	Y	CD, DH, DEM, Plants, aromatic candle, Supply blocked by clutter
102	33	70	37	1133	ND	ND	2	Y	Y	Y	1 CT visible mold, DH, DEM, Food storage/use, Exhaust blocked by clutter
101	0	71	37	880	ND	ND	2	Y	Y	Y	DH, Plants, 1 MT/AT
110	30	72	38	1081	ND	ND	2	N	Y	Y	CD, DH, DEM, Cleaners
111	37	72	40	1626	ND	ND	2	Y	N	Y	DEM, Food storage/use, Cleaners, Cake batter
203	0	69	34	650	ND	ND	2	N	Y	Y	Breach sink/counter, CD, DEM, Supply occluded by dirt/debris, Exhaust occluded by dirt/debris

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									Supply	Exhaust	
202	0	68	35	760	ND	ND	2	Y	Y	Y	CD, DEM, Dust, Cleaners, Supply occluded by dirt/debris, air plug in freshener, 28 students left ~ 30 minutes, Clay
206	24	70	40	699	ND	ND	2	Y	Y	Y	PF, DEM, Food storage/use, Items hanging on ceiling, Exhaust blocked by clutter, Breach sink/counter
211	23	70	38	786	ND	ND	3	Y	Y	Y	DEM, Clutter, Cleaners, Glue gun, Items hanging from ceiling, Food storage/use, Supply blocked by clutter and furniture
212	0	71	36	824	ND	ND	3	Y	N	Y	DEM, Cleaners, Breach sink/counter, Supply univent set to low-but off, Supply blocked by clutter, Exhaust occluded with dirt/debris

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									Supply	Exhaust	
205	0	69	35	679	ND	ND	3	Y	Y	Y	CD, DEM, Cleaners, Feathers, Supply blocked by furniture
204	0	69	36	648	ND	ND	2	Y	Y	Y	DEM, Cleaners, Breach sink/counter, Supply blocked by clutter and occluded by dirt/debris/pencil shavings
213	0	69	36	639	ND	ND	2	Y	Y	Y	CD, DEM, Food storage/use, 26 left an hour ago, Supply blocked by clutter and furniture
210	23	72	42	1303	ND	ND	2	N	Y	Y	Breach sink/counter, CD, DEM, Food storage/use, Cleaners, Exhaust blocked by clutter
207	23	71	39	999	ND	ND	2	Y	N	Y	DEM, Food storage/use, Cleaners, Odor

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									Supply	Exhaust	
209	34	72	40	1191	ND	ND	2	Y	Y	Y	DEM, Clutter, Cleaners, Supply blocked by clutter, Exhaust blocked by clutter and furniture
208	31	71	41	1784	ND	ND	2	N	Y	Y	1 WD-CT, DEM, Food storage/use, Clutter, Cleaners, Supply blocked by clutter, Exhaust blocked by furniture
222	0	69	34	604	ND	ND	2	Y	Y	Y	1 MT/AT
223	23	68	40	579	ND	ND	2	N	Y	Y	DEM
224	0	70	39	541	ND	ND	2	Y	Y	Y	DEM, Clutter, Supply occluded with dirt/debris
221 (motor room)	3	71	40	683	ND	ND	2	Y	Y	Y	CD, DEM, Cleaners

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									Supply	Exhaust	
214	28	69	41	932	ND	ND	2	N	Y	Y	Breach sink/counter, Clutter, Cleaners, Supply blocked by clutter and furniture, Exhaust blocked by furniture and occluded by dirt/debris
215	0	69	41	845	ND	ND	2	Y	Y	Y	CD, DEM, Clutter, Supply blocked by clutter and furniture
220	26	71	42	922	ND	ND	2	Y	Y	Y	Breach sink/counter, 1 CT visible mold, DEM, Cleaners, Supply blocked by clutter
216	28	70	41	1031	ND	ND	2	Y	Y	Y	CD, DEM, Cleaners, Exhaust blocked by furniture
219	29	69	40	788	ND	ND	2	Y	Y	Y	CD, DEM, Clutter, Cleaners, Exhaust blocked by clutter and furniture

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									Supply	Exhaust	
217	0	70	40	705	ND	ND	2	Y	Y	Y	CD, DEM, Univents-pleated filter clean, Exhaust blocked by clutter and furniture.
218	22	72	41	880	ND	ND	2	Y	Y	Y	CD, Food storage/use, Dust, Clutter, Dry clay art, Crack in corner, Exhaust occluded by dirt/debris, 1 WD-CT
Resource 4	0	69	38	580	ND	ND	2	Y	N	Y	Window mounted A/C, Supply natural-window
Resource 3	0	68	38	557	ND	ND	2	Y	N	Y	Window mounted A/C, 1 MT/AT
201	0	69	38	683	ND	ND	2	Y	Y	Y	Breach sink/counter, AP, Food storage/use, Dust, Clutter, Cleaners, Supply-spider webs, Exhaust occluded by dirt/debris
Resource 2	2	69	42	905	ND	ND	2	Y	N	Y	DEM

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									Supply	Exhaust	
Resource 1	3	68	41	800	ND	ND	2	Y	N	N	PF, Cleaners
Sprinkler Room (Near Central)											Odor; old, WD insulation

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